



FREEDOM OF INFORMATION REQUEST

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FOI Reference number: FOI 35/2022

Date: 16 December 2022

Request:

In 1979 I was wearing body armour in the RUC /PSNI that weighed nearly 2 stone and I was trying to drive armoured police vehicles that had no power steering.

A recent UK Pol Fed group established that officers from across England and Wales are being referred to treatment centres with back, shoulder and neck pain, which could be caused by wearing body armour. So, what about Northern Ireland?

The association between back, neck and musculoskeletal pain has been long known by the Policing board, The Police Authority, and the Police Service for many years.

Please supply all the links to documents the PBNI hold or have access to, in relation to the damage Body Armour can cause?

Answer:

A search of records held by the Northern Ireland Policing Board has revealed the attached document produced in November 1995 as a result of research commissioned by the then 'Police Authority for Northern Ireland'. Where redactions have been made this is to remove third party names as per Section 40 (2) of the FOI Act.

We have also identified a Police Authority file entitled 'Body Armour – Hard' 1986 – 1987 which is held by the Public Records Office Northern Ireland (PRONI) which may contain information relating to this request. The PRONI reference number for this file is PA/7/3.

PRONI can be contacted by post at the address below:

Public Record Office of Northern Ireland
2 Titanic Boulevard
Titanic Quarter
Belfast
BT3 9HQ

Or by e-mail: access@communities-ni.gov.uk.

In addition the Police Service of Northern Ireland [PSNI] may hold this type of information.

You can contact the PSNI Freedom of Information Team by post at the address below:

Freedom of information Team Corporate Development Brooklyn
65 Knock Road
Belfast
BT5 6LE

Or by e-mail: foi@psni.pnn.police.uk

If you have queries about this request or the decision please contact the Board quoting the reference number above. If you are unhappy with the service you have received and wish to make a complaint or request a review you should write to the Board's Chief Executive at the following address:

Northern Ireland Policing Board
Waterside Tower
31 Clarendon Road
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Belfast BT1 3BG

Email: foi@nipolicingboard.org.uk

You should contact the Board within 40 working days of this response.

If you are not content with the outcome of your complaint, you may apply directly to the Information Commissioner. Generally, the Information Commissioner's Office cannot investigate or make a decision on a case unless you have exhausted the complaints procedure provided by the Board. The Information Commissioner can be contacted at: -

Information Commissioner's Office
Wycliffe House
Water Lane
Wilmslow
SK9 5AF

Telephone: - 0303 1231114

Email: - ni@ico.org.uk

Please be advised that Policing Board replies under Freedom of Information may be released into the public domain via our website @ www.nipolicingboard.org.uk.

Personal details in respect of your request have, where applicable, been removed to protect confidentiality.

Determinants for low back trouble in police officers

with particular reference to the Royal Ulster Constabulary

Conducted and compiled by:

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The Occupational Health Unit, Royal Ulster Constabulary ²
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Commissioned and funded by:

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Summary

Introduction: The aim was to identify physical occupational stressors and psychosocial factors related to the onset and pattern of low back trouble (LBT) in police officers. It was a questionnaire-based survey of 1885 police officers from two forces which were known to be discordant for exposure to one physical factor (wearing of overt body armour weighing ~8 kg), and perhaps discordant for work-related stress (exposure to terrorist danger)

Methods: Anamnestic data reflecting individual history of LBT was collected in 1995, along with variables describing the working environment and sports participation in each of the preceding 6 years (1989-1994). Psychosocial data were collected using the Psychosocial Aspects of Work questionnaire (PAW) and the General Health Questionnaire (GHQ). The police forces were The Royal Ulster Constabulary (RUC) - the 'exposed' force, and The Greater Manchester Police (GMP) - the 'control' force. Response rates for representative random samples of the two forces were 77.5% and 62.5% respectively. Very few officers leave the service on health grounds.

Results: The mean age and mean length of service did not significantly differ between the forces. The lifetime prevalence of LBT was statistically significantly higher in the RUC than the GMP (69.2% v. 62.9%); the point prevalence difference (34.7% v. 29.4%) was almost significant. The RUC officers were significantly more likely to report having persistent trouble, were more likely to have taken sick leave, and more likely to believe that their trouble was caused by their work. The psychosocial scores did not

differ significantly between the forces, neither did average sports participation. Occupational risk factors for first-time incidence of LBT were determined by focusing on those officers who had no history of LBT before joining the force. Life-table analysis showed that survival time to initial onset was adversely affected principally by the wearing of body armour and, to a lesser extent, by the number of hours spent in vehicles and sports participation (one or more sessions/week). At the time of questioning, officers with a history of LBT had diminished PAW scores, and they were more distressed (GHQ). The percentage of officers who had developed persistent (chronic) trouble by 1995 was independent of the length of service since the onset; but the number of further years in service did affect the percentage moving from a single spell to episodic trouble. Officers with persistent trouble were significantly more distressed (GHQ), whilst those who believed that police work was the cause of their trouble were less likely to have just a single spell. Interestingly a change to lighter duties in the year following onset was rare (average <3%). Work loss may be influenced as much by psychosocial as by physical factors

Discussion: This study, focusing on incidence rates and temporal patterns of back trouble in service, supports the contention that an occupational environment likely to induce regular spinal loading (i.e. body armour and vehicular vibration) is detrimental; it reduces the survival time to first onset of LBT and is associated with recurrence. The limited influence of physical factors on persistence raises some questions, but strengthens the association between psychosocial factors and chronic back trouble.

Background

Low back trouble had been perceived as an increasing health problem affecting the officers of the Royal Ulster Constabulary [RUC], manifesting both as attendances at the Occupational Health Unit and as sickness absence. The impression of the Occupational Health Unit staff was that the problem was particularly prevalent among RUC officers compared with the rates given in epidemiological reports from other occupational groups. Anecdotal reports from officers had implicated the wearing of body armour as a primary factor in the development and persistence of low back trouble.

In recognition of the problem, and following discussions within the Police Authority, it was decided to embark on a questionnaire-based epidemiological study of the prevalence of low back trouble in the RUC, and to attempt identification of work-related factors (both physical and psychosocial) associated with the disorder. In 1994 the Spinal Research Unit of the University of Huddersfield was contracted to assist with the design and conduct of this study, the aims of which are detailed below.

Aims of the study

1. To establish the incidence and prevalence rates for low back trouble among RUC officers, and to make comparisons with a control group of police officers.
2. To identify risk factors for low back trouble among RUC officers, and to make comparisons with a control group of police officers. Specifically to determine the effect of wearing body armour on incidence and prevalence rates for low back trouble among RUC officers.
3. To explore the influence of exposure to body armour in the persistence of low back trouble.
4. To relate the findings to the existing scientific literature.
5. To provide recommendations, where possible, which might minimise any existing problem

Overall conduct of the study

The Spinal Research Unit [SRU] was contracted specifically to: (a) perform the appropriate literature searches, (b) advise and assist in the experimental design of the study, and in the design of the questionnaires, (c) perform the analysis of the data, (d) prepare a report on the findings.

The Occupational Health Unit [OHU] and Operational Research [OR] at the RUC were responsible for the following tasks in respect of the RUC and a control force: (a) printing the questionnaires, (b) establishing a random sample, (c) distributing and collecting of questionnaires, (d) preparation of data.

The Greater Manchester Police [GMP] was considered to be a suitable control force, in that its officers, like those of the RUC, work across a large mixed urban/rural region with a difficult inner city area. The GMP kindly agreed to their officers acting as the control group. The RUC team were responsible for liaising with the GMP to arrange sampling of their officers using an identical methodology as that for the RUC.

The project commenced with a preliminary meeting on 4th October 1994 between representatives of the RUC and the SRU. This meeting enabled the SRU staff to become familiar with the work of the RUC and the equipment typically used by the officers. A series of discussions permitted the questions of interest to the RUC to be formulated against a background of what was reasonably practicable from a scientific perspective.

The information sought by the questionnaire fell into four broad categories: [1] demographic data, [2] history of any experience of low back trouble, [3] history of exposure to potential risk factors for low back trouble, [4] current psychosocial measures. The anamnestic history of low back trouble experience and history of exposure to potential risk factors was sought for a six year period [1989-1994].

Following the initial meeting the SRU team designed a first draft of the questionnaire which was sent to the RUC team for comment. After a sequence of drafts, a pilot version of the questionnaire was tested on a small group of officers to establish its utility and validity. Comments from these officers contributed to the final format as presented in Appendix A.

Data collection was commenced in late February 1995. The data were delivered to the SRU in the middle of April 1995.

Introduction

Low back trouble (LBT) has become a major health problem for the industrialised nations; there has been an dramatic rise in the level of disability attributed to this disorder over the last twenty years or so, but there has been no documented evidence that experience of the disorder itself is increasing. The lifetime prevalence rate for low back trouble is about 59% in adults in the United Kingdom ¹ with similar prevalence in males and females. Recurrences occur in at least 70% of sufferers ² leading to a point prevalence rate of 27% among the general working population in the UK. Most authorities now consider the disorder to be more or less endemic, but that psychosocial issues are of particular importance for the increasing disability rate, and consequent work loss ³.

With such a prevalent disorder it is difficult to identify risk factors ⁴, and indeed a review of the literature reveals conflicting evidence. Some studies have reported that heavy physical exertions at the workplace are associated with an increased prevalence of LBT ^{5,6}, whilst others have failed to find this relationship ^{7,8}. Driving (vehicular vibration) has been found to be associated with transient symptoms of back pain ⁹, and has also been associated with an increased prevalence of back trouble ¹⁰, but again this has not been a universal finding ¹¹. Much of the previous work has been concerned with relating particular potential risk factors to the existence of a history of the disorder among occupational groups, but little attention has been given to relationships with its first-time development. Some recent UK statistics on back injury from the Health & Safety Executive show a two fold variation in back injury rates across occupational groups, but this variation is not clearly related to heavy manual work ¹². There is conflicting evidence as to whether physical risk factors which induce spinal loading result in pathological change in the spine ^{13,14}, but heavy work does seem to be associated with increased work loss ¹⁵; this increase may not to be due to a higher number of spells off work, rather to spells of longer duration ¹⁶. The lifetime prevalence of work loss in the UK due to back trouble has been found to be 28% ¹⁷. So far as the subsequent course of the disorder is concerned, work-type issues do not seem to be as influential as, say, the characteristics of the first spell of trouble ⁷, but clinically a poorer outcome has been found in patients with heavy physical jobs ¹⁸

Recent reports have suggested that psychosocial factors such as job satisfaction have been shown to be related to back injuries in aircraft workers ¹⁹, leading to the assumption that similar factors may dictate the need for work absence. However, a study in light-industrial workers failed to confirm this notion ²⁰.

Although the relationship between work and back trouble (and its attendant disability) is complex, the general consensus from the literature is that work issues (particularly those related to spinal loading) are important in both the development of the disorder and its progression; indeed some 35% of UK workers with a history of LBT believe that it is work-related².

So far as police officers, as an occupational group, are concerned, there is surprisingly little information concerning LBT. In 1985, the Spinal Research Unit interviewed 55 officers of the West Yorkshire Police as part of a large survey of workers⁷. The lifetime prevalence of LBT was found to be 56.4% with a point prevalence of 14.5%, whilst 25.8% of those with a history had symptoms at the time of interview, and 58% had had some time off work. In Ontario, Canada, a survey of 346 police officers revealed a lifetime prevalence of 33% compared with a rate of 42% in firefighters in the same municipality²¹. In that study, back injuries were associated with the duration of employment. Another survey, in Los Angeles, USA found that all back injuries, including first-time back injury, were associated with overexertion and that work loss was associated with litigation²².

As part of a large occupational survey of LBT, Magora (in 1974) interviewed a small sample of Israeli police officers (n=16)²³. He found that fatigue from work was frequently blamed as a cause of LBT, and that police officers were more inclined than other occupational groups to consider their work an aggravating factor. In a later publication (based on the same data set) he found a positive relationship between sitting for longer than 4 hours per day and LBT, but made no distinction between sitting in vehicles or in offices²⁴. A Canadian study of participatory ergonomics considered the design of patrol cars²⁵. Whilst the officers involved with the redesign exercise initially were very concerned about back-related issues, this tendency diminished during the process; unfortunately the project did not include an attempt to estimate any benefits that might have resulted in respect of LBT.

From a scientific point of view, police officers are a potentially useful group for the study of low back trouble and its determinants; they are a well defined 'vocational' group, they are likely to be subject to both physical and mental stressors during the course of their work, and they are likely to be physically fit; it has been reported among firefighters that increased physical fitness can lead to a reduction in back injuries²⁶.

Police officers in general are likely to be a useful group in which to study factors related to the development (first-time onset) of LBT as well as its subsequent course. They tend to join the force at relatively early age (before the incidence of LBT becomes substantial¹⁷); they perform a variety of duties (imposing varying demands on the spine); they tend to remain in their chosen occupational environment, and they are trained to be competent witnesses. The officers of the RUC represent a group of police officers who, whilst performing traditional

police duties, are exposed to two particular stressors not encountered (to the same extent) in other police forces, *i.e.* the wearing of overt body armour and exposure to the terrorist threat.

Overt body armour has been worn regularly by officers of the RUC for 15 or more years. The weight of this armour is substantial at around 8 kg; due to the insertion of ceramic plates front and back necessary to afford protection against high velocity rifle bullets. The garments are not only heavy but also bulky, leading to awkward movements and postures. Covert body armour (worn occasionally by officers of both the RUC and the GMP) is much lighter and less bulky; it can be surmised that its use imposes significantly lower stresses on the spine. Officers of both forces are likely to be exposed to vehicular vibration; much police work is likely to involve substantial periods of travelling in vehicles. For the officers of the GMP this exposure will be largely in conventional vehicles, whilst many officers of the RUC are likely to spend time in vehicles modified such that the suspension characteristics will be altered (presumably the addition of armour plating will produce a harsher ride); stiff suspension has been found to be related to back pain symptoms in Grand Prix racing drivers⁹. In addition, it is likely that substantial numbers of officers in the RUC will spend time in vehicles with the additional loading and constraint from overt body armour.

The officers of the RUC thus form a unique group of subjects, data from whom could help to establish factors related to the onset and persistence of LBT, as well as factors associated with disability (work loss). A study comparing aspects of LBT in officers of the RUC with officers from another force, discordant for the stressors of particular interest, is a practicable approach to addressing these questions.

Hypotheses

1. Prolonged exposure to overt body armour by serving police officers is a risk factor for the first-time development of low back trouble.
2. Prolonged exposure to vehicular vibration by serving police officers is a risk factor for the first-time development of low back trouble; this effect will be heightened by the concomitant wearing of overt body armour.
3. Continued wearing of body armour after development of low back trouble will result in an increased likelihood of progression to persistent (chronic) trouble.
4. Work loss due to low back trouble will be higher in police officers exposed to overt body armour and/or who show negative psychometrics (measured as attitudes towards work).
5. Police officers who participate regularly in sports activities are less likely to experience low back trouble than those who do not take regular exercise.

Methods

The study design was cross-sectional with data collection being by means of self-administered questionnaires. The study subjects comprised representative random samples of the forces concerned. Both current and retrospective information was to be collected.

The pre-determined sizes of the random samples were: 2000 full-time officers from the RUC and 600 full-time officers from the GMP [17.8% and 9.4% of the forces in 1995 respectively]. Response rates were 77.5% (n = 1508) from the RUC and 62.5 % (n = 377) from the GMP, giving a total study population of 1885 police officers.

Initial distribution of the questionnaires by OR was followed up with one reminder letter. The data were entered into a computer database then coded, checked and cleaned before being sent to the SRU. The statistical package used for the analyses was SPSS for Windows.

Data

Depending on the analysis, the data were considered as three sets:

- A) The total sample.
- B) The sample after exclusion of officers who had had back trouble before entering the force.
- C) The sample after further exclusion of officers who joined the forces before 1980.

Statistics

The data from the total sample were initially explored using univariate statistics to compare the two forces in respect of the main variables of interest, to establish the extent to which the two forces were well matched and identify ways in which they differed. The variables relating to potential risk factors for low back trouble were treated in a number of ways: (1) For the basic comparisons between RUC and GMP (using the subset with no back trouble prior to joining the force) an average score, based on the answers given for each of the six years, was computed; the weighting values assigned to the variables when calculating these averages are given in the results-tables. (2) For estimation of relative risk (using officers with no back trouble prior to 1986) four principal physical-risk-factor groups were identified based on exposure to the physical stresses of body armour and vehicular vibration (the latter was considered as vehicle use for more than 2 hours per day, so as to exclude those with just domestic exposure). The groups were defined as follows:

1. *no vib/no ba*: Neither in vehicles for 2+ hours per day nor wore overt body armour
2. *no vib/yes ba*: **Not** in vehicles for 2+ hours per day but **did** wear overt body armour
3. *yes vib/no ba*: **In** vehicles for 2+ hours per day but **did not** wear overt body armour
4. *yes vib/yes ba*: **In** vehicles for 2+ hours per day and **did** wear overt body armour

Preliminary exploration of the data indicated that individual officers rarely changed from one of these four exposure categories to another. So the category used to classify the nature of the exposure for each officer was: (1) the category in 1994 for those who had not had an onset; (2) the category in the year of onset for those who had. The length of exposure was measured from the year of joining the force.

The physical stress of carrying longarms was considered, but the overlap (high positive correlation) between this variable and the wearing of body armour precluded separate analysis. Finally, the influence of regular sports participation (categorised as none/one or more sessions per week) was explored.

For the four main exposure groups, life-tables were drawn up to establish the form of the '%survival' function (hereinafter termed '%avoidance of LBT') and the '%hazard' function. These two percentages should be clearly distinguished.

- The %avoidance at the end of, say, year 6 is the percentage of *officers who started the study without LBT* and who have **not** succumbed in those 6 years.
- The %hazard during, say, year 6 will be the percentage of *those officers who have not succumbed in the 5 years prior to the 6th year* but **do** succumb during that year.

To supplement the life-table analyses, Cox proportional-hazard model regression analysis was used where appropriate. Having established estimates of avoidance and hazard, multiple regression was used to explore the statistical significance of the slopes and interaction. The analysis was repeated with 'sports participation' replacing vibration. Other possible explanatory variables (e.g. height and sex) were also considered using these approaches.

The psychosocial questionnaires were both scored using the Likert scales built into each instrument. The Psychosocial Aspects of Work questionnaire (developed by the SRU) permits description of three psychometric parameters related to the work situation: Job Satisfaction, Social Support and Mental Stress - higher scores are associated with more 'positive' attitudes towards work. The General Health Questionnaire is widely used as a measure of psychological distress - higher scores are associated with mental distress. Comparative analysis utilised Analysis of Variance and Duncan's Multiple Range test.

The level of statistical significance was set at 5%

Results

Initial analysis

The descriptive statistics are given separately for the RUC and GMP officers in Table 1.

The samples of the two forces were very similar in respect of demographic characteristics such as age at time of questioning, age at entry to the force and length of service. The RUC sample had a higher preponderance of male officers, and the overall proportion of females (~10%) was too small to form a basis for separate analyses of differences between the sexes.

Table 1. Descriptive statistics of selected variables from the study populations: RUC officers (n= 1508) and GMP officers (n= 377)

	RUC	GMP
Age [mean, SD] - years	38.3 [8.8]	37.5 [7.2]
Sex [% male]	92%	87%
Age joined force [mean, SD] - years	23.4 [6.5]	22.2 [4.1]
Years in service [mean, SD] - years	14.8 [7.6]	15.2 [7.9]
Lifetime prevalence of LBT	69.2%	62.9%
Point prevalence of LBT	34.7%	29.4%
History of leg pain in those with history of LBT	55.4%	50.2%
Age at initial onset of LBT [mean, SD] - years	28.7 [7.9]	28.9 [7.7]
No history of back trouble before joining force	89.7%	90.9%
Years of service before first-onset of LBT [mean]	6.6	8.2
Frequency of LBT - <i>one spell</i>	10.7%	19.0%
Frequency LBT - <i>episodic</i>	58.8%	58.2%
Frequency LBT - <i>persistent</i>	30.5%	22.8%
Symptom-free for >1 year prior to interview	32.7%	38.2%
Current symptoms in those with a history of LBT	50.3%	46.8%
Work absence needed for LBT since first spell	43.3%	32.6%
Work absence needed for LBT in 1994	22.0%	18.3%
Work believed to be a cause of LBT	82.5%	68.9%
PAW score - <i>job satisfaction</i> [mean, SD]	27.1 [6.3]	27.2 [5.9]
PAW score - <i>mental stress</i> [mean, SD]	14.5 [3.4]	14.8 [2.9]
PAW score - <i>social support</i> [mean, SD]	15.2 [3.1]	15.4 [2.7]
GHQ score [mean, SD]	11.0 [5.2]	10.7 [5.1]
Headaches often [%]	16.9%	16.4%
Never smoked [%]	36.0%	34.2%

[**Bold type:** statistically significant difference between RUC and GMP]

The lifetime prevalence of LBT (defined as the percentage of officers who had ever experienced the complaint at the time of questioning) was significantly and substantially higher in the RUC. However the point prevalence (defined as those who said they were experiencing a spell of LBT on the day of questioning) was similar in both forces, as was the proportion of LBT subjects who had experienced sciatica (leg pain) associated with their LBT. The average age at which they had first experienced trouble did not differ significantly between the forces, and nor did the proportion who had not had back problems before joining up. But, the RUC officers succumbed significantly sooner after joining (mean 6.6 v 8.2 years). Temporal patterns of back pain were categorised on the basis of the officers' perception of how frequently they experienced back trouble: 'isolated' (only one discrete spell of trouble by the time of questioning), 'episodic' (has occurred as a number of spells) or 'persistent' (the condition is perceived as a constant problem). The distribution of these patterns differed substantially between the forces; the RUC officers were more likely to report that their back trouble was a persistent problem. So far as work absence for LBT at some time after the initial spell is concerned, officers in the RUC were more likely to have needed to take time off work (but in the single year of 1994 the forces were similar). A higher proportion of RUC officers believed that their back problems were due to their work, but the mean Psychosocial Aspects of Work (PAW) and General Health Questionnaire (GHQ) scores were similar between the two forces.

Table 2 presents the results for factors perceived to influence LBT among those officers with a history of the complaint. So far as aspects of work perceived as a cause of the trouble were concerned, body armour was blamed by a striking proportion of the RUC officers (80.1%); another factor blamed significantly more often by the RUC was road traffic accidents. Difficult arrests, lifting, and falling were cited more often by the GMP. Looking at the work factors which aggravated or relieved existing LBT revealed relatively few significant differences between the forces; in addition to body armour, RUC officers more often than GMP officers reported driving and standing to be aggravating factors, and that walking was a relieving factor.

The next part of the analysis focused on the exposure to a number of risk factors suggested in the literature as being important for the initial onset or persistence of low back trouble. For hours spent in vehicles, the average was taken for each force for each year; for the other variables, the proportion exposed during each year was used. Table 3 presents a summary of exposure to selected risk factors for LBT tabulated by force, over the six years concerned. It was expected that the RUC and GMP would be discordant for wearing of body armour, and this was the case (both for overt and covert varieties). Predictably, the carrying of longarms was higher in the RUC, and was closely correlated with wearing of body armour; because of this correlation it was impossible to separate carrying-longarms from body armour as risk

factors in later analyses. The time spent in vehicles (hours/day averaged across the sample) by RUC officers was greater than that for GMP officers (around 30 to 45 minutes per day longer). There were no substantial inter-force differences in the extent of sports participation.

Table 2. Perceived influences on LBT [n = 1280 RUC and GMP officers who had had LBT]

	RUC	GMP
Aspects of work as cause of LBT [% responding yes]		
road traffic accident	20.5	13.4
difficult arrest	12.1	25.0
lifting	8.0	20.1
fall	7.2	15.9
prolonged sitting	32.6	40.2
body armour	80.1	2.4
vehicles	43.8	51.8
Factors aggravating LBT [% responding yes]		
driving	29.2	36.3
walking	9.1	10.1
lying	11.7	11.4
sitting	29.7	30.4
standing	49.1	35.4
carrying	22.0	23.6
body armour	71.2	1.7
vehicles	27.6	27.8
Factors relieving LBT [% responding yes]		
walking	38.1	27.4
lying	37.4	40.9
sitting	11.2	11.0
standing	6.3	11.0
movement	51.7	51.5

[**Bold type:** statistically significant difference between RUC and GMP]

Table 3. Summary of exposure to selected risk factors for RUC and GMP officers over the six years for which information was collected.

	1989	1990	1991	1992	1993	1994
RUC						
Hours spent in vehicles/day [mean]	5.4	5.3	5.3	5.2	5.1	5.0
Wore overt body armour in vehicles [%]	60	59	57	57	54	50
Overt body armour worn [%]	67	65	65	65	63	59
Covert body armour worn [%]	5	6	5	5	5	4
No body armour worn [%]	28	29	30	30	32	37
Longarms carried [%]	44	42	42	42	40	38
Sidearms carried [%]	44	45	44	44	47	51
No arms carried [%]	12	13	14	14	13	11
Sports participation < 1 session/week [%]	48	47	47	47	50	51
Sports participation 1-2 sessions/week [%]	29	30	31	31	30	28
Sports participation 3+ sessions/week [%]	23	23	22	22	20	21
GMP						
Hours spent in vehicles/day [mean]	4.7	4.6	4.8	4.6	4.6	4.4
Wore overt body armour in vehicles [%]	2	2	2	2	1	1
Overt body armour worn [%]	8	8	7	6	6	5
Covert body armour worn [%]	1	2	2	2	3	3
No body armour worn [%]	91	91	91	92	91	92
Longarms carried [%]	1	1	1	0	0	0
Sidearms carried [%]	2	2	2	2	2	1
No arms carried [%]	97	97	97	98	98	99
Sports participation < 1 session/week [%]	45	46	43	43	44	49
Sports participation 1-2 sessions/week [%]	26	26	31	31	29	27
Sports participation 3+ sessions/week [%]	28	28	26	26	27	24

[**Bold type:** statistically significant difference between RUC and GMP]

Next, the average exposure (per force) to the potential risk factors was calculated over the six years covered by the questionnaire. Exposure to vehicular vibration was the average number of hours per day, whilst for the psychosocial variables the mean score was used. For the other variables the values allocated to the questionnaire responses were averaged; these values were chosen to represent the direction and extent of risk suggested from the literature (the actual coded values are given in Table 4). The average exposure to potential risk factors and the development of LBT in those officers who entered the force without a history of LBT, both for RUC and GMP are given in Table 4; the column headed LBT refers to those officers who developed LBT at some time between joining the force and the time of questioning (1995). The results given in Table 4 show that the development of LBT in RUC officers was associated with a higher number of hours in vehicles and/or the wearing of body armour, lower job satisfaction, lower social support at work and a higher level of psychological distress. For GMP officers only psychological distress was significant, being higher in the LBT group.

Table 4. Average exposure to potential risk factors and the development of LBT in officers who had no history of LBT before joining the force. [Exposure calculated for the period 1989 through 1994: some officers had been exposed in earlier years. PAW and GHQ scores are those at the time of questioning in 1995].

	RUC		GMP	
	no LBT	LBT	no LBT	LBT
Hours/day in vehicles [mean hours]	4.9	5.4	4.9	4.6
Wearing body armour [mean: overt = 3, covert = 1, none = 0]	1.8	2.0	0.2	0.2
Body armour + vehicles [mean: yes = 2, no = 1]	1.5	1.6	1.0	1.0
Carrying firearms [mean: longarms = 1, sidearms or none = 0]	0.4	0.4	0.1	0.1
Sports [mean: 3+ times/wk = 3, 1-2 times/wk = 1, <1 times/wk =0]	1.7	1.7	1.8	1.6
PAW - job satisfaction [mean score]	27.9	26.9	27.6	27.0
PAW - mental stress [mean score]	14.5	14.6	14.6	15.0
PAW - social support [mean score]	15.6	15.0	15.8	15.3
GHQ score [mean score]	9.9	11.4	9.6	11.1

[**Bold:** statistically significant difference between those with and those without LBT within the force]

Turning to current back symptoms (*i.e.* symptoms on the day of questioning), and using the same approach, it was found that wearing of body armour, high levels of mental stress at work and psychological distress were associated with current symptoms among the RUC officers, but there were no significant relationships for the GMP officers (Table 5).

The relationships between the selected risk factors and the temporal patterns of low back trouble are shown in Table 6. For both RUC and GMP officers, the belief that police work was a cause of the trouble was associated substantially more with episodic and persistent trouble. Lower job satisfaction was related to these two categories among the GMP officers, whilst

RUC officers with a higher level of psychological distress were more likely to have persistent trouble. Interestingly, the wearing of body armour and exposure to vehicular vibration was not associated with temporal patterns.

Table 5. Average exposure to potential risk factors and current low back symptoms (point prevalence) in officers who had no history of LBT before joining the force. [Exposure calculated for the period 1989 through 1994: some officers had been exposed in earlier years. PAW and GHQ scores are those at the time of questioning in 1995].

	RUC		GMP	
	no symptoms	symptoms	no symptoms	symptoms
Hours/day in vehicles [mean hours]	5.3	5.6	4.8	4.4
Wearing body armour [mean: overt = 3, covert = 1, none = 0]	1.9	2.1	0.3	0.1
Body armour + vehicles [mean: yes = 2, no = 1]	1.6	1.6	1.0	1.0
Carrying firearms [mean: longarms = 1, sidearms or none = 0]	0.4	0.5	0.0	0.0
Sports [mean: 3+ times/wk = 3, 1-2 times/wk = 1, <1 times/wk = 0]	1.7	1.7	1.8	1.7
PAW - job satisfaction [mean score]	27.2	26.6	26.5	27.6
PAW - mental stress [mean score]	14.3	14.9	14.7	15.4
PAW - social support [mean score]	15.1	15.0	15.1	15.4
GHQ score [mean score]	10.6	12.2	11.4	10.8

[**Bold:** statistically significant difference between those with and those without current symptoms within the force]

Table 6. Average exposure to potential risk factors (or percentage) across three temporal patterns of LBT in officers who had no history of back pain before joining the force. [Exposure calculated for the period 1989 through 1994: some officers had been exposed in earlier years. PAW and GHQ scores are those at the time of questioning in 1995].

	RUC			GMP		
	isolated	episodic	persistent	isolated	episodic	persistent
Hours/day in vehicles [mean hours]	5.6	5.4	5.4	4.7	4.6	4.7
Wearing body armour [mean: overt= 3, covert = 1, none = 0]	1.9	2.1	2.0	0.2	0.3	0.1
Body armour + vehicles [mean: yes = 2, no = 1]	1.6	1.6	1.6	–	1.4	1.4
Carrying firearms [mean: longarms = 1, sidearms or none = 0]	0.4	0.4	0.1	0.0	0.0	0.0
Sports [mean: 3+ times/wk = 3, 1-2 times/wk = 1, <1times/wk = 0]	1.7	1.7	1.7	1.7	1.8	1.6
Belief that police work was a cause of LBT [% responding yes]	54%	86%	89%	36%	77%	83%
PAW - job satisfaction [mean score]	27.1	27.1	26.4	28.8	26.5	26.8
PAW - mental stress [mean score]	14.2	14.7	14.7	15.2	14.9	15.0
PAW - social support [mean score]	15.0	15.0	15.0	15.3	15.3	15.2
GHQ score [mean score]	10.8	11.0	12.0	10.6	11.6	10.5

[**Bold:** statistically significant difference from other temporal patterns within the force]

The influence of exposure to selected risk factors on work loss during 1994 was also explored. For both forces a higher average number of hours per day in vehicles over the six years was associated with absence. For RUC officers, the combination of body armour and

vehicle use, and (separately) the belief that police work was to blame for the trouble were more likely to lead to absence (Table 7).

In view of the relationships found between LBT and various aspects of police work, the proportion of officers, from both forces combined, changing duties following development of back trouble was investigated. Table 8 gives the proportion of officers who moved to either heavier or lighter duties in the year following first-time onset of back trouble during the years 1989-1993. Heaviness of duties was considered in terms of whether or not the duties involved vehicular vibration or wearing of body armour; the order of heaviness was - neither, vibration only, body armour only, vibration + body armour. Over the five years studied less than 8% of officers changed duties, with a greater proportion (4.5%) changing to heavier work than to lighter work (3.1%).

Table 7. Average exposure to potential risk factors (or percentage) and 1994 work loss during due to LBT for officers who had no history of back pain before joining the force. [Exposure calculated for the period 1989 through 1994: some officers had been exposed in earlier years. PAW and GHQ scores are those at the time of questioning in 1995].

	RUC		GMP	
	no absence	absence	no absence	absence
Hours/day in vehicles [mean hours]	5.2	6.1	4.4	5.5
Wearing body armour [mean: overt = 3, covert = 1, none = 0]	2.0	2.2	0.2	0.3
Body armour + vehicles [mean: yes = 2, no = 1]	1.5	1.6	1.0	1.0
Carrying firearms [mean: longarms = 1, sidearms or none = 0]	0.4	0.5	0.0	0.0
Sports [mean: 3+ times/wk = 3, 1-2 times/wk = 1, <1times/wk = 0]	1.7	1.7	1.7	1.8
Belief that police work was a cause of LBT [% responding yes]	81%	91%	68%	79%
PAW - job satisfaction [mean score]	27.1	26.1	26.6	28.5
PAW - mental stress [mean score]	14.6	14.5	15.0	14.9
PAW - social support [mean score]	15.1	14.9	15.2	15.6
GHQ score [mean score]	11.2	12.1	11.2	10.9

[**Bold:** statistically significant difference from other category within the force]

Table 8. Changes of exposure to physical stressors (movement to heavier or lighter duties) in the year following the year of first-onset for officers who had no history of back trouble before joining the force.

First-onset	% (n) changed to heavier duties	% (n) changed to lighter duties	unchanged
1989-1993	4.5% (19)	3.1% (13)	92.4% (389)

Nearly fifty percent of respondents were from Beat & Patrol. On average these officers were low on all scores compared with other groups, suggesting a profile of low job satisfaction and low social support on the one hand, but low mental stress and low distress on the other.

Table 10. Mean psychosocial scores [SD] across the type of duty performed in 1994, for RUC and GMP officers combined. (The slight differences in terminology between the forces for types of duties are not accounted for in this table; they were insubstantial so far as the analysis is concerned)

	Beat & patrol	Traffic	Special branch	CID	HQ/admin.	Training branch	MSU	Other
PAW - job satisfaction	26.3 [6.1]	28.8 [5.0]	29.3 [5.4]	27.8 [5.9]	27.6 [6.4]	28.8 [5.0]	26.0 [6.6]	27.6 [6.6]
PAW - mental stress	14.4 [3.3]	15.2 [2.9]	15.1 [3.0]	15.9 [2.9]	15.3 [3.4]	15.0 [3.1]	13.1 [3.3]	14.3 [3.6]
PAW - social support	14.9 [3.0]	14.9 [3.2]	16.2 [2.8]	15.8 [2.9]	15.7 [3.1]	15.5 [2.9]	14.9 [3.0]	15.3 [3.2]
GHQ score	10.9 [5.2]	11.4 [6.3]	9.5 [4.1]	11.4 [5.0]	11.3 [5.6]	9.8 [4.6]	10.9 [5.5]	11.5 [5.4]

[No single group was significantly different from all the others for any score]

Psychometrics - symptomatic status of LBT

Those officers with a history of LBT were found to be more distressed, less satisfied with their work, and perceived less social support from colleagues than officers with no previous history of LBT. The level of mental stress was similar between officers with and without a history of LBT. Interestingly though, those officers who were suffering a current spell of LBT when they completed the questionnaires had significantly more mental stress at work than those who were not suffering. The officers with current symptoms were also generally more distressed than those without current symptoms; however, level of job satisfaction and amount of social support from colleagues was not related to symptom-status (Table 11).

Psychometrics - temporal patterns and work loss

Officers who stated that they had isolated LBT, rather than episodic or persistent trouble, were less distressed and were more satisfied with their work. The scores for social support and level of mental stress experienced at work did not differ between the isolated, episodic trouble, and persistent trouble groups. Whether or not work loss had resulted from LBT in 1994 was not related to job satisfaction, social support, or mental stress recorded in 1995, but a slightly higher level of distress occurred in those who had taken absence (Table 11).

Psychometrics - body armour

Officers who regularly had been exposed to body armour were more negative on work related factors (job satisfaction and social support) than those not exposed to body armour, but not on stress related factors (distress and mental stress). A similar pattern was found between officers who blamed body armour as the cause of their LBT and those who did not blame body armour, *i.e.* a significant difference on work related factors and little difference on the stress related factors (Table 11).

Table 11. Mean psychosocial scores [SD] for symptomatic status, temporal patterns, work loss in 1994, regular exposure to body armour (ba), and blaming of body armour for symptoms.

	no LBT	history of LBT	no symptoms	current symptoms
PAW - job satisfaction	27.8 [6.0]	26.9 [6.1]	27.1 [6.0]	26.5 [6.6]
PAW - mental stress	14.5 [3.2]	14.7 [3.3]	14.4 [3.4]	14.8 [3.3]
PAW - social support	15.7 [2.9]	15.1 [3.1]	15.1 [2.9]	15.0 [3.2]
GHQ score	9.8 [4.5]	11.4 [5.4]	10.8 [5.3]	12.1 [5.6]
	isolated spell	episodic LBT	persistent LBT	
PAW - job satisfaction	27.6 [5.6]	26.9 [6.2]	26.5 [6.4]	
PAW - mental stress	14.5 [3.4]	14.7 [3.3]	14.8 [3.4]	
PAW - social support	15.1 [2.9]	15.1 [3.1]	15.1 [3.3]	
GHQ score	10.8 [5.9]	11.2 [5.4]	12.0 [5.3]	
	no work loss in 1994	work loss in 1994		
PAW - job satisfaction	26.9 [6.3]	26.2 [6.3]		
PAW - mental stress	14.6 [3.4]	14.6 [3.4]		
PAW - social support	15.1 [3.1]	14.9 [3.2]		
GHQ score	11.3 [5.3]	12.1 [6.1]		
	no regular ba	regular ba exposure	did not blame ba	blamed ba
PAW - job satisfaction	27.9 [5.8]	26.7 [6.3]	27.2 [6.4]	26.3 [6.3]
PAW - mental stress	15.2 [3.1]	14.4 [3.5]	14.8 [3.4]	15.5 [3.4]
PAW - social support	15.6 [2.9]	15.0 [3.1]	15.4 [2.9]	14.8 [3.2]
GHQ score	11.0 [5.1]	11.1 [5.3]	11.3 [5.4]	11.8 [5.7]

[**Bold type:** significant differences between categories]

Detailed analysis of physical stressors for initial onset of back trouble

Four primary physical-risk-factor groups were identified based on exposure to vehicular vibration (vib) and overt body armour (BA); the method of analysis is described under

Methods:

1. no vib/no ba
Not in vehicles for 2+ hours a day and did not wear overt body armour
2. no vib/yes ba
Not in vehicles for 2+ hours a day but did wear overt body armour
3. yes vib/no ba
In vehicles for 2+ hours a day but did not wear overt body armour
4. yes vib/yes ba
In vehicles for 2+ hours a day and did wear overt body armour

The following life-table analysis is based on the 909 officers who joined the force in 1980 or later

Avoidance

Definition: The *avoidance* at the end of, say, year 6 is the percentage of the officers who started the study without LBT who have not succumbed in those 6 years.

The avoidance profile (Fig. 1) suggests that:

- The average rate at which the four groups succumbed to LBT over the 10 year period and median avoidance times are:
 - no vib/no ba: 4.3% per annum 15+ years
 - no vib/yes ba: 8.2% per annum 7.0 years
 - yes vib/no ba: 7.8% per annum 8.9 years
 - yes vib/yes ba 6.3% per annum 7.5 years
- The two groups wearing body armour (*i.e.* yes or no vibration) were not significantly different.

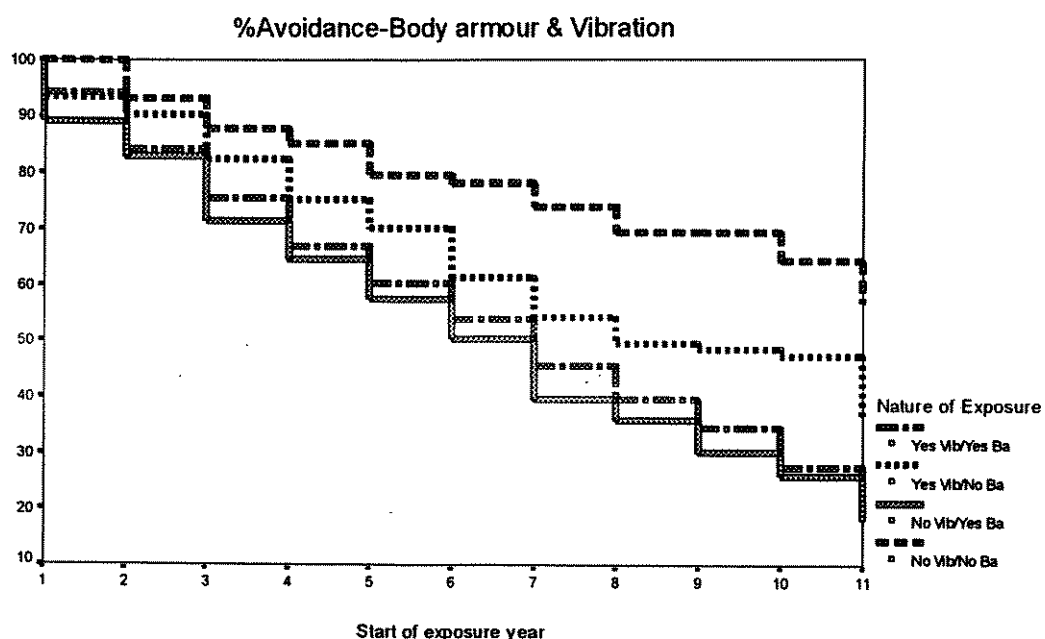


Figure 1. Patterns of low back trouble Avoidance associated with body armour and vibration.

Hazard

Definition: The *hazard* over a given year is the percentage of officers who succumb for the first time during that year. Thus the hazard during, say, year 6 will be the percentage of officers who have not succumbed in the 5 years prior to the 6th year who do succumb during the year. Because of the inability to separate the two groups wearing body armour they were merged into one group for an analysis of hazards.

The hazard profile (Fig. 2a) shows that taking an overall view of a 11-year span:

- The lowest hazard for succumbing to LBT at any time is for those with neither vibration nor body armour exposure (the baseline group).
- Exposure to vibration increases the hazard.
 - The additional hazard does not depend greatly upon years of exposure to vibration.
- Exposure to body armour increases the hazard.
 - The additional hazard does depend upon the length of exposure to the hazard.

Simple straight-line models would suggest that the annual hazard associated with an initial spell of LBT increases from 2.5 to 7% over a 10-year period for those who neither wear body armour nor spend prolonged periods in vehicles (the base-line group). The additional hazard due to spending prolonged periods in vehicles is about 4.5%, and only decreases slightly over the years. The annual hazard for those wearing body armour goes from 10% in the first year of service to 17.5% in year ten. As the slope is significantly different from zero only for those wearing body armour, the underlying mean hazard for the non-body-armour groups is estimated to be constant at values of 5.5% and 10% respectively.

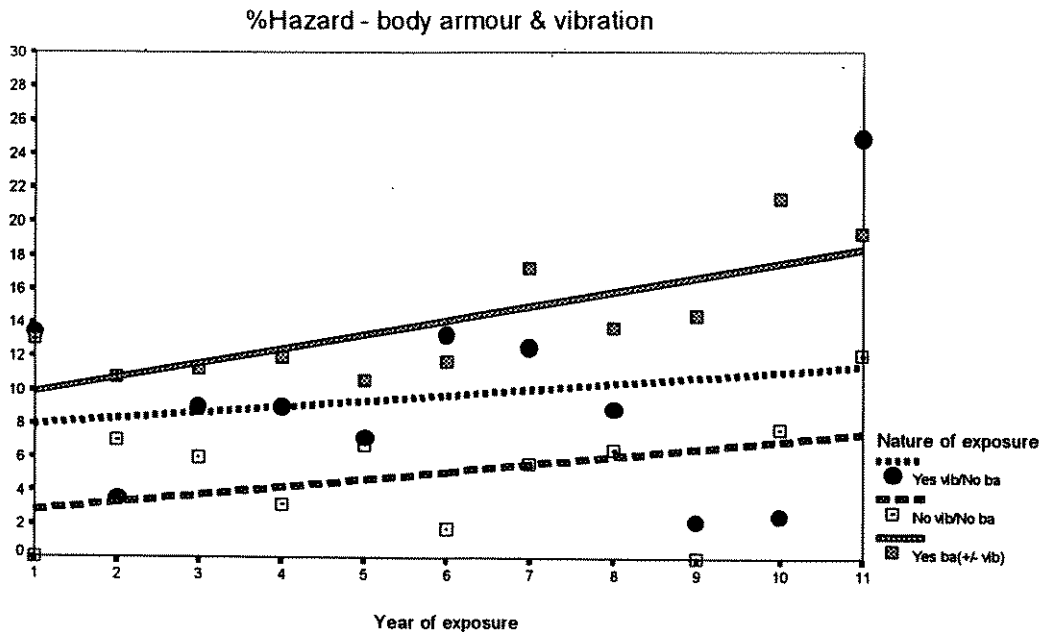


Figure 2a. % Hazard associated with body armour and vibration.

Figure 2b shows that, if only the first six years of exposure are considered, there is no systematic change in hazard. The hazard for the group subjected to prolonged vehicle exposure is less than for those wearing body armour, but greater than for those experiencing neither of the physical risks. Only the base line group have a significantly different mean %Hazard.

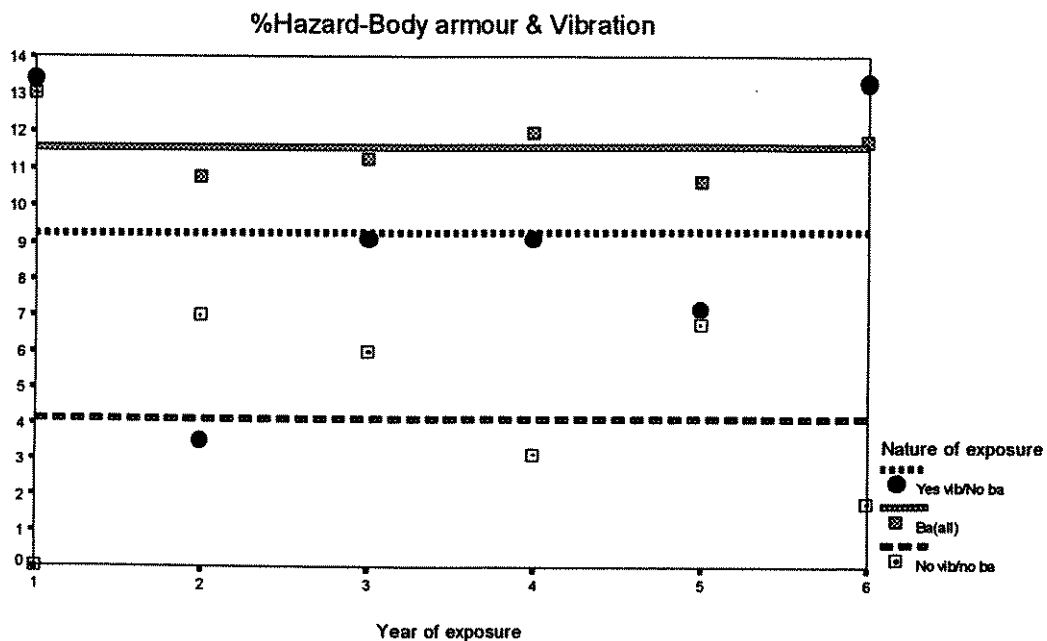


Figure 2b. % Hazard associated with body armour and vibration - pattern of sample values.

The annual hazard associated with an initial spell of LBT is typically 4% for each of the first six years for those who neither wear body armour nor spend prolonged periods in vehicles (the base-line group). The additional hazard due to spending prolonged periods in vehicles is about 5%. During the first 6 years, the additional hazard (over and above the hazard experienced by the base-line group) due to wearing body armour is typically 7.5%. Expressed in terms of relative hazards, an officer wearing body armour is about three times as likely, and one without body armour (but with prolonged sitting in vehicles) about twice as likely, to have an initial onset in any one year as is an officer with neither risk factor.

Patterns of psychosocial scores for these four physical-risk groups were established. Table 12 shows the mean score for no vib/no ba and the difference in mean score for each of the physical risk factors: The apparent added job satisfaction of using vehicles whilst not having to wear body armour contrasts with the lower job satisfaction of those using vehicles who do have to wear body armour. Of the two groups wearing body armour, those on foot suffer have a lower mental stress score than those who are in vehicles, but the two groups are negative to a similar extent about the social support they receive.

Table 12 Mean psychosocial scores for the four physical-risk groups (based on LBT-free entrants to the forces).

	no vib/no ba	yes vib/no ba	no vib/yes ba	yes vib/yes ba
PAW - job satisfaction	27.6	+0.5	-0.7	-1.1
PAW - mental stress	15.3	-0.4	-1.7	-1.0
PAW - social support	15.8	-0.3	-0.7	-0.9
GHQ score	11.0	-0.4	-0.6	-0.1

[**Bold type:** significant differences from base-line No vib/No ba group]

The potential hazard of sports participation was explored. Figure 3 shows that for those who do wear body armour, regular sports participation becomes an additional hazard. After an apparently protective spell, the additional hazard increases over the years.

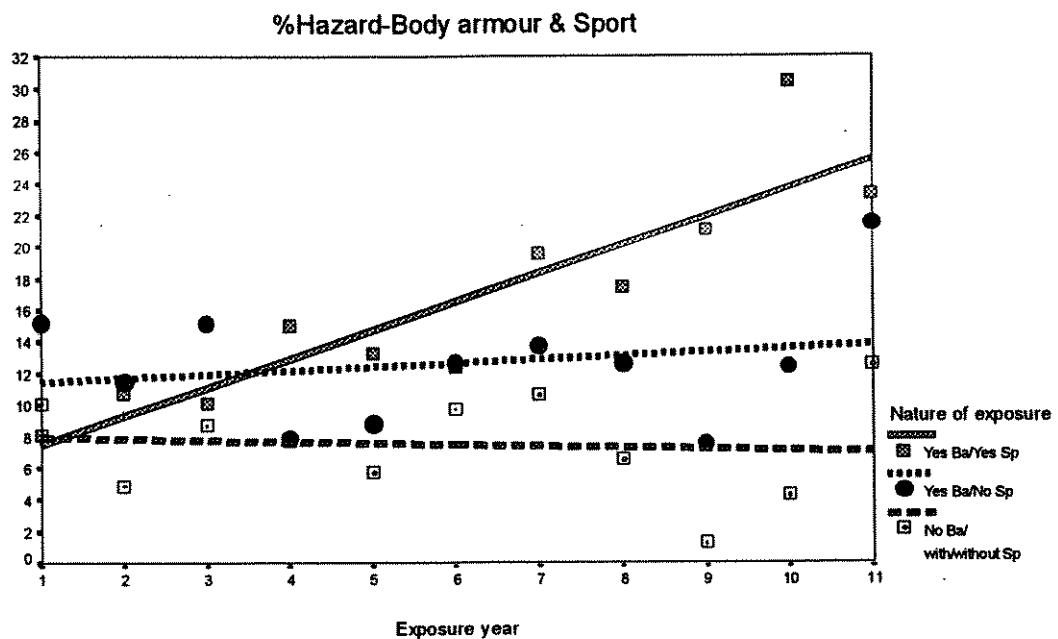


Figure 3. % Hazard associated with body armour and sport.

An analysis of the propensity to have time-off-work associated with LBT gave the results shown in Table 13. For both the absence related to first-onset and subsequent absence, the percentages between groups are significantly different. For first-onset absence, the baseline group are significantly less likely to take time off than are the other groups, whilst for subsequent absence there is a more even graduation between groups; the split is between those who wear body armour and those who do not.

Table 13 Percentages of those with LBT requiring time off work.

	no vib/no ba	yes vib/No ba	no vib/yes ba	yes vib/yes ba
No absence for first-onset	65%	49%	56%	53%
Absence for first-onset	35%	51%	44%	47%
No absence since	73%	70%	62%	58%
Absence since	27%	30%	38%	42%

[Bold type: group significantly different from comparable non-bold group]

Prevalence of a history of LBT- police officers and UK males in general

The prevalence of a history of low back trouble in the two exposure groups and among police officers (represented by the RUC and GMP officers separately) is compared with figures from a comprehensive study of UK males ¹⁷.

The data in Table 14 show that:

- Despite selecting mainly officers without a history of LBT for entry to the force, lifetime prevalence in the RUC tended to be higher than that for UK males at all ages.
- GMP officers were not found to be significantly different from UK males.
- The reason for the difference between the forces appears to lie in the contribution from the wearing of body armour.

Table 14. Lifetime prevalence of LBT (%) for male police officers compared with UK males ¹⁷.

Age (yr)	UK males	RUC	GMP	no ba GMP	no ba RUC	yes ba RUC
20-29	52	66	55	52	—	66
30-39	60	74	62	59	62	77
40-49	64	71	68	69	58	75
Overall	61	69	62	61	58	72

[Bold type: significant differences from UK Males]

The impact of physical stressors on temporal patterns of LBT following onset

Figure 4 shows how subsequent temporal patterns of LBT (isolated, episodic, persistent) relate to the number of years of continued service since onset for officers who had their first onset after joining the force. Whilst the percentage of officers reporting an isolated spell falls away with increasing service, and the percentage of officers reporting episodic trouble builds up with increasing service, the percentage of officers reporting persistent trouble is roughly

the same (~30%) irrespective of the interval since initial onset. The likelihood of persistent trouble did not depend on the length of continued service; *i.e.* the perception that the problem was a persistent condition was as likely after one year of additional service as after five years.

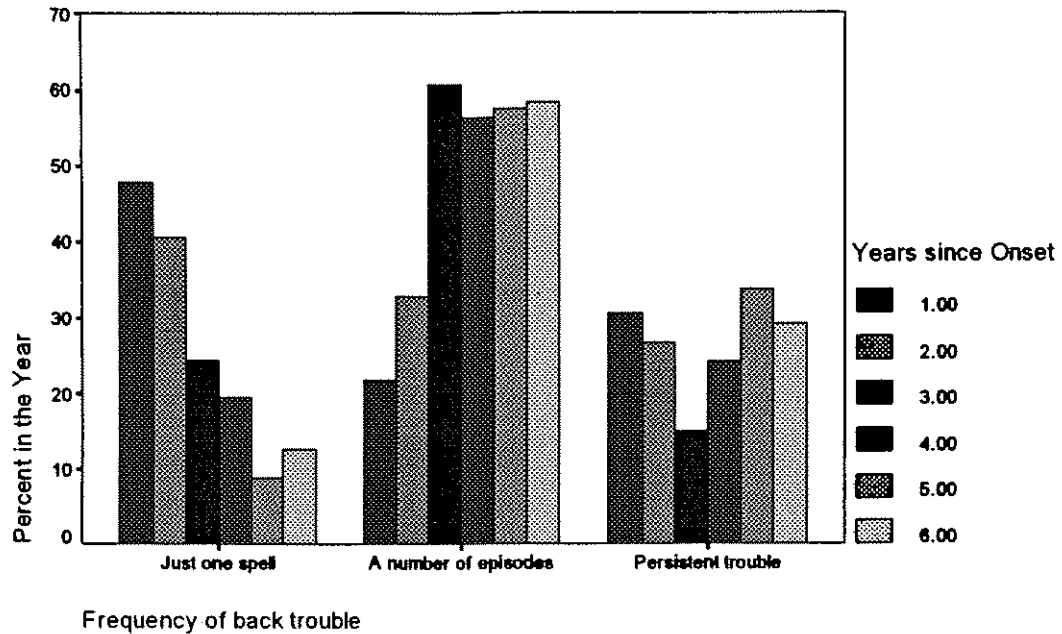


Figure 4. Temporal patterns of LBT related to length of service since initial-onset.

As well as considering the effect of additional years of service on temporal patterns, the cumulative hazard, representing the 'dose' of physical stressors over time, was explored. Cumulative hazard was estimated for each officer with relative weights based on the hazards for initial onset. The mean cumulative hazard was calculated for each temporal pattern category over the period of service up to a maximum of 10 years. The episodic and persistent categories had similar mean cumulative hazard values and were found to be significantly different from the mean for the isolated category (Table 15). Stated simply, increased dose of physical stressors led to further discrete episodes, but those with persistent (chronic) low back trouble had not had a further increase in dose. Indeed a low dose can be associated with persistent symptoms, as suggested by the data in Figure 4.

Table 15. Weighted cumulative hazard score (arbitrary units) by temporal patterns of LBT

	Isolated	Episodic	Persistent
n	99	304	119
mean	12.5	23.7	23.7
SD	14.3	19.8	20.9

[Bold: statistically significant difference from other categories]

Discussion

This study concerned a large sample of police officers from two forces which were believed to be discordant for two factors of primary interest; heavy overt body armour and work-related psychosocial stress. The aims were to answer specific questions related to the RUC, to test a number of hypotheses related to occupational low back trouble, and to formulate recommendations based on the results. Before discussing those results and drawing conclusions, it is important to estimate both the likely validity of the data, and the extent to which the results can be generalised.

Methodology

Of practical necessity, and in common with most surveys of large populations, this study employed questionnaires to obtain data from volunteers. The magnitude of overall sampling error was expected to be small; a random sampling procedure was used, an adequate sample size was chosen, and a good response rate was achieved (~70%). Checks against known parameters for the forces, leads us to believe that the samples were representative of the forces concerned. So far as anamnesis is concerned, police officers, as a group, might reasonably be expected to have good recall (by virtue of their training and day-to-day involvement in matters of fact) whilst the questionnaires were carefully constructed to minimise ambiguity and request information in a logical and structured manner. The historical data in respect of low back trouble was requested using questions that had previously been found satisfactory for various other groups of workers⁷, and details of work history were limited to a period (six years) that might reasonably be expected to be accurately recalled by a stable vocational group. The psychosocial data was obtained using well validated instruments. We are confident that the samples of the RUC and GMP were representative of the officers in the forces in 1995, and that the data was sufficiently accurate to answer the scientific questions posed. In addition, retirement rates due to back problems in these forces was very low.

Because low back trouble is a particularly frequent disorder within the general population over the age of about 20 years, it is difficult to estimate the influence of risk factors when looking just at prevalence rates. Rather, it is more pertinent to consider first-time incidence of the disorder when seeking potentially causative factors. The early age for recruitment of police officers (*i.e.* prior to the substantial rise in incidence above the age of ~30 years in the general population^{1,17}) together with a policy of discouraging recruitment of individuals with prior back pain history, provided the opportunity in this study to focus the risk analysis on officers with no previous history of back problems. In so doing, it was intended that the information gained would enable determination of risk factors for first-time onset.

Furthermore, the fact that police officers were likely to remain in the force for long periods led us to believe that further information could be gleaned regarding the subsequent course of LBT. The results indicated that these assumptions were correct; the average age at entry was 23 years, some 90% denied any back problems prior to joining the force, the average age at first-onset was 28 years, and the average length of service was 15 years.

Comparison with the literature

The pattern of lifetime prevalence of LBT in UK police officers, as represented by the data from the RUC and the GMP, was found to be very similar to that for the UK population in general. However, the RUC officers had a significantly higher prevalence, particularly between 20 and 39 years of age, whilst the (slight) excess prevalence of the GMP officers was not statistically significant. The UK figures, being based on the general population, include all types of work (and also non-workers). It may be that 'conventional' police work (represented by the GMP) entails similar physical hazards to that found in an over-view of the general population. The relatively increased prevalence in the RUC is matched by an increased prevalence associated with wearing of overt body armour.

When comparing the present data with that from the West Yorkshire force in the mid 1980s⁷, the lifetime prevalence is fairly similar, but the point prevalence is much greater than that previously found (>30% : ~15%); this difference is probably an artefact from the small sample in the previous study. The lifetime prevalence in UK officers seems to be somewhat higher than in Canadian officers²¹, but it is difficult to make a direct comparison because the form of the questions concerning LBT may have been different.

The impression is that the overall prevalence of LBT in the 'conventional' group of police officers from the GMP is not dramatically different from the UK population in general, but the RUC officers have a higher prevalence than the general population, the GMP and Canadian officers. The most obvious factor that may account for this difference is the regular wearing of overt body armour by the officers of the RUC.

There was a greater likelihood of persistence of symptoms among police officers when compared with the 20% reported for general UK population² (31% for RUC; 23% for GMP). Interestingly this difference was associated more with the psychosocial factors than with cumulative exposure to physical stressors.

Risks from physical stressors

A recent report has positively related occupational physical stressors to the presence of a history of LBT²⁸. That report was of particular importance because it represents the first study to relate epidemiological findings with quantitative biomechanical findings. However, the research design only considered the previous three years of back injuries in existing

workers; it did not take into account the overall length of exposure or the possibility of any stressors that might have been present from other (previous) occupations, neither did it consider the progression of the disorder. The present study of police officers offers additional information. It is, so far as we are aware, the first to explore the hazard from occupational physical stressors in an occupational group who were (a) recruited at an early age, (b) free of trouble at recruitment, and (c) exposed to the same stressors for long periods. This gave the unique opportunity to study not only the relationship between stressors and first-time onset of LBT, but also the effect of continued exposure on ensuing temporal patterns.

A clear hazard for the first-onset of LBT has been found from occupational exposure to heavy overt body armour. The hazard found for exposure to vehicles (without the additional factor of body armour) is rather less clear cut because it is based largely on data from the smaller control force. It has also been shown that increasing exposure to the hazards is associated with recurrence of trouble, but is not associated with persistent symptoms.

The hypotheses stated earlier concerning the effects of physical stressors on the experience of low back trouble stemmed from an underlying concept evident in the literature. That concept is that back trouble arises from some mechanical insult to the structure of the spine following exposure to physical stressors. A number of assumptions are generally made: (1) the stressor acts to precipitate back pain; (2) the effect variously may be experienced after either short- or longer-term exposure; (3) continued exposure to the stressor will serve to perpetuate the trouble; (4) removal of the stressor will reduce or eliminate the problem.

The results of this study lend support to the 'mechanical insult model': (1) the stressors were associated with first-time back pain; (2) some officers avoided symptoms for quite long periods, whilst others succumbed early in their exposure; (3) continued exposure lead to further episodes. However, the supposition that further continued exposure would ultimately lead to a level of biomechanical failure that would give rise to persistent trouble is not supported. Unfortunately no information is available concerning the possible beneficial effects of removing the stressors.

That psychosocial stressors are significant factors in the persistence of back symptoms is generally accepted, and this study did not refute that hypothesis. However, the limited range of psychosocial factors studied necessarily limited the conclusions that could be drawn; measures of such dimensions as cognitive coping strategies might have been more revealing. Nevertheless, the results here confirm the previously reported lack of relationship between Psychosocial Aspects of Work and absence due to low back trouble²⁰.

This results of the present work enabled us to make the following statements in respect of the hypotheses proposed:

1. Prolonged exposure to overt body armour by serving police officers is a risk factor for the first-time development of low back trouble.

This hypothesis was supported

2. Prolonged exposure to vehicular vibration by serving police officers is a risk factor for the first-time development of low back trouble; this effect will be heightened by the concomitant wearing of overt body armour.

The first part of this hypothesis was supported, but the second part was not.

3. Continued wearing of body armour after development of low back trouble will result in an increase in the proportion of officers with persistent trouble.

This hypothesis was not supported.

4. Work loss due to low back trouble will be higher in police officers exposed to overt body armour and/or who show negative psychometrics measured as attitudes towards work.

The first part of this hypothesis was supported, but the second was not.

5. Police officers who participate regularly in sports activities are less likely to experience low back trouble than those who do not take regular exercise.

This hypothesis was refuted for the officers exposed to heavy body armour.

Conclusions

With the caveat that the basis is largely self-reported anamnestic data collected in the simplified form obtained from use of a questionnaire, the following conclusions can be drawn:

- In general terms:
 - Physical stressors (wearing body armour and prolonged sitting in vehicles) precipitate the onset of an initial spell of low back trouble:
 - Despite LBT being endemic in the population, 90% of entrants to the police service are free from LBT on entry.
 - Fifty percent of these LBT-free entrants would be expected to remain free for over 15 years if it were not necessary for them to be exposed to these two physical risk factors.
 - On average wearing body armour brings forward the onset by at least 7.5 years.
 - On average prolonged sitting in vehicles appears to bring forward the onset by at least 6 years but this estimate is based on a small sub-group of the officers.
- Considering the first six years of service:
 - The annual hazard associated with an initial spell of LBT is typically 4% in each year during the six year period for those who neither wear body armour nor spend prolonged periods in vehicles (the base-line group).
 - The additional hazard due to spending prolonged periods in vehicles is about 5%.
 - During these first 6 years, the additional hazard (over and above the hazard experienced by the base-line group) due to wearing body armour is typically 7.5% but increases in the following years.
 - Expressed in terms of relative hazards, compared with an officer with neither risk factor:
 - An officer wearing body armour is about 3 times more likely to have an initial onset in any one year.
 - With prolonged sitting in vehicles an officer is about 2 times more likely to have an initial onset in any one year.
- Considering the overall pattern for the first ten years of service:
 - Regression analysis would suggest that the annual hazard associated with an initial spell of LBT is typically 5.5% over the 10-year exposure for those who neither wear body armour nor spend prolonged periods in vehicles (the base-line group).
 - The additional hazard due to spending prolonged periods in vehicles is about 4.5%.
 - The additional annual hazard over the base-line group attributable to wearing body armour goes from 4.5% in the first year of service to 12% in year 10.
- The impact of these stressors on officers who already have experienced their initial spell must be assessed in the light of the general trend for temporal patterns of LBT. It might

be expected that the trend would be from 'Isolated' to 'Episodic' to 'Persistent' over a period of years:

- The evidence is that proceeding to 'Persistent' rather than 'Episodic' is not dependent upon the number of years since first onset, but could depend more upon the attitudes of the individual officer than upon the physical stressors. On the basis of one measure of the cumulative stress due to wearing body armour, prolonged sitting in vehicles and sports participation, the evidence is that continued physical stress is indeed associated with progression from 'Isolated', but that the mean cumulative stress associated with 'Episodic' and 'Persistent' are not dissimilar.
- The impact of psychosocial stressors on the onset and progression of LBT is more difficult to tease out:
 - Beat & Patrol officers report lower job satisfaction and social support but also less distress and a lower mental stress score. Within this group, those wearing body armour tend to be more negative on these psychosocial measures.
 - After the onset of LBT, Psychosocial Aspects of Work were not significantly related to the future course of the disorder.
 - Belief of police work being a cause of LBT was significantly associated with LBT that had progressed from 'isolated'.
 - RUC officers with 'persistent' trouble were more distressed (GHQ) than the other groups.
- Considering work loss
 - It seems that wearing of body armour (RUC) and, to a lesser extent, prolonged sitting in vehicles are associated with work loss, but:
 - RUC officers who believed police work was a cause were more likely to have had time off work, Blaming work was closely associated with wearing body armour.
 - There is insufficient evidence to show that the psychosocial measures (PAW and GHQ) in 1994 are substantially related to the likelihood of having taken time off work for LBT, either at time of initial onset or since.
- The impact of sports participation on time to first-onset does not appear to be as hypothesised:
 - Whilst the contrary influences of injury and fitness are recognised, it appears that injury risks dominate for the group of officers who wear body armour whilst on duty.

Recommendations

It would be inappropriate to make strong recommendations about longer term hazards based on remembrance of matters that occurred more than five years previously. However the following tentative recommendations can be made:

- It is to be expected that a large proportion of officers joining the force will experience LBT; this is the background epidemiology of the disorder. However, a disproportionate number will develop persistent trouble.
 - Current medical opinion suggests that early active management of LBT is important to reduce the likelihood of chronicity.
 - ⇒ It is recommended that a system for early access to appropriate advice and treatment be available.
 - The most recent research shows that this tendency to persistence is related to psychosocial beliefs and attitudes within the individual.
 - ⇒ It is recommended that educational information be provided to help officers understand that LBT is not usually disabling and that a positive attitude can reduce the risk of unnecessary disability.
- Officers who wear heavy (~8 kg) overt body armour will have a greater propensity to succumb to low back trouble. The situation in respect of vehicle use is less clear-cut.
 - Knowledge of these hazards should be viewed in the light of the Management of Health and Safety at Work Regulations 1992.
 - ⇒ Should a need arise for heavy overt body armour in the future, it is recommended that the Regulations be duly considered; officers probably should be warned of the hazard and further assessment would be justified.
 - It appears that the hazard is uniform over the first 6 years but there is some evidence that hazards are higher in subsequent years for those wearing the heavy

overt body armour. To confirm this hypothesis would require a further detailed study of the histories of individual officers. If confirmed, there may be implications for patterns of duty, and redesign of job and/or equipment.

⇒ It is recommended that such studies be considered.

- The physical hazard from wearing body armour likely comprises two dimensions; spinal loading and awkward postures/movements. To disentangle these dimensions would require detailed ergonomic task analyses and estimates of spinal loading. It is presently unknown whether lighter overt body armour carries a hazard; this could be investigated in forces such as GMP.

⇒ It is recommended that such experiments be conducted

- The recent cessation of the use of body armour by the RUC will allow confirmation of the findings of this report on the basis of data collected solely within the RUC.
- Review of the RUC after a period of three years without regular use of overt body armour should reveal a reduction in the hazard for development of LBT.

⇒ It is recommended that a second survey be conducted.

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Appendix A

The questionnaires used in the study

Survey of

BACK PAIN AMONGST POLICE OFFICERS

1995

A few words of introduction:

Back pain is a major problem for many groups of workers, but there is little information about its effects on police officers. This survey, based on a random sample of officers, is designed to find out the extent of the problem. More importantly, it will help us find the right solutions for you and your fellow officers.

We need to know a bit about you, your work, any back pain you've had, and also something about your general health.

- Please take the time [about 15 minutes] to respond to **all** the sections in this booklet.
- WE WOULD BE GRATEFUL IF YOU COULD RETURN IT BY MARCH 15th USING THE ENVELOPE PROVIDED.

You can be assured that your responses are totally anonymous - you cannot be identified in any way.

This project is fully supported by the Federation and the Superintndents Association

THANK YOU VERY MUCH FOR YOUR HELP



Section A

• **This is the section about you and your work**

1. Age now:
2. Sex: [circle] M / F
3. Year joined the police: 19
4. What height are you? feet inches

5. History of work with the force:

What type of work have you been employed in during the last six years?

* Please circle just one number for each year to show the duty you were MOST involved in.

[Do not mark years when not in the force]

<u>Duty type</u>	<u>1994</u>	<u>1993</u>	<u>1992</u>	<u>1991</u>	<u>1990</u>	<u>1989</u>
Beat & patrol	1	1	1	1	1	1
Traffic	2	2	2	2	2	2
Special branch	3	3	3	3	3	3
CID	4	4	4	4	4	4
HQ/station admin.	5	5	5	5	5	5
Training branch	6	6	6	6	6	6
MSU	7	7	7	7	7	7
Other	8	8	8	8	8	8

6. Do you ever have headaches? [circle appropriate description]

hardly ever ₁ / daily ₄ / weekly ₃ / monthly ₂

7. History of your work experience with the force and sports participation. For each year please circle the numbers that are appropriate for you. *[Do not mark years not in the force]*

Year	Rank [state]	Type of duty most of time	Type of body armour most regularly worn	Type of firearm most regularly carried on duty	Sports participation [sessions / week]
1994		1 Uniform 2 Non- uniform	1 Ordinary/Overt 2 Covert/white 3 None	1 Longarms 2 Sidearms 3 None	< 1 session/wk ₁ 1-2 sessions/wk ₂ 3+ sessions/wk ₃
1993		1 Uniform 2 Non- uniform	1 Ordinary/Overt 2 Covert/white 3 None	1 Longarms 2 Sidearms 3 None	< 1 session/wk ₁ 1-2 sessions/wk ₂ 3+ sessions/wk ₃
1992		1 Uniform 2 Non- uniform	1 Ordinary/Overt 2 Covert/white 3 None	1 Longarms 2 Sidearms 3 None	< 1 session/wk ₁ 1-2 sessions/wk ₂ 3+ sessions/wk ₃
1991		1 Uniform 2 Non- uniform	1 Ordinary/Overt 2 Covert/white 3 None	1 Longarms 2 Sidearms 3 None	< 1 session/wk ₁ 1-2 sessions/wk ₂ 3+ sessions/wk ₃
1990		1 Uniform 2 Non- uniform	1 Ordinary/Overt 2 Covert/white 3 None	1 Longarms 2 Sidearms 3 None	< 1 session/wk ₁ 1-2 sessions/wk ₂ 3+ sessions/wk ₃
1989		1 Uniform 2 Non- uniform	1 Ordinary/Overt 2 Covert/white 3 None	1 Longarms 2 Sidearms 3 None	< 1 session/wk ₁ 1-2 sessions/wk ₂ 3+ sessions/wk ₃

8. Which region are you currently working in?

9. Please indicate in the grid below the time you have spent in vehicles during the last 6 years

[Do not mark years when not in the force]

Year	Approx. how many miles did you travel to work?	Approx. how many hours per day did you spend in vehicles [incl. to & from work]	Did you generally wear overt body armour whilst in vehicles at work.
1994	.....miles	.....hours	Yes ₂ / No ₁
1993	.....miles	.....hours	Yes ₂ / No ₁
1992	.....miles	.....hours	Yes ₂ / No ₁
1991	.....miles	.....hours	Yes ₂ / No ₁
1990	.....miles	.....hours	Yes ₂ / No ₁
1989	.....miles	.....hours	Yes ₂ / No ₁

Section B

- **This is the section on back pain**

10. Have you ever experienced pain or trouble from your lower back [other than normal aches and stiffness after, say, gardening]?

No: ₁ [go to *Section C*]

Yes: ₂ [go to next question]

11. Have you ever had leg pain [sciatica] with your back trouble?

No: ₁ Yes: ₂

12. Are you currently having any back trouble?

No: ₁ Yes: ₂

13. Has your back trouble occurred as: [circle the appropriate description]

Just one spell ₁

A number of episodes ₂

Persistent trouble ₃

14. How old were you when you first ever had back trouble? years

14.1. Roughly, how long did that first spell last? [circle the appropriate description]

days ₁

weeks ₂

months ₃

over a year ₄

it didn't get better ₅

14.2. Did you need treatment for that first spell?

No: ₁ Yes: ₂

14.3. Were you off work during that first spell?

No: ₁ Yes: ₂

15. Have you **ever** had to take bed rest for more than 3 days for your back?

No: ₁ Yes: ₂

16. Since the first spell, have you needed time off work (because of your back)?

No: ₁ Yes: ₂

17. How long since you had any back trouble (circle)? less than a year₁ / 1-2 years₂ / longer₃

18. Do you believe that work has been a cause of your back trouble? [circle one or more]

it never caused it ₁ [go to question 20]

it caused the first spell ₃

it caused a recurrence ₂

19. What aspects of police work do you think resulted in your back trouble? [circle one or more]

RTA ₁

Fall ₄

Wearing body armour ₇

Difficult arrest ₂

Prolonged sitting ₅

Being in vehicles ₈

Lifting ₃

Bomb explosion ₆

Non-police work ₉

20. In general, what makes your back feel worse? (circle as many as apply)

driving ₁ / walking ₂ / lying ₃ / sitting ₄ / standing ₅ / carrying ₆ / wearing body armour ₇ / vehicles ₈

(other?.....)

21. In general, what makes your back feel better? (circle as many as apply)

driving ₁ / walking ₂ / lying ₃ / sitting ₄ / standing ₅ / movement ₆

(other?.....) ₈

22. What diagnosis have you been given (if any)?

.....

22.1 Who made this diagnosis?

23. How much time did you have to take off work during 1994 due to your back? [circle one]

0 days ₁ / 1-6 days ₂ / 1-3 weeks ₃ / 1-6 months ₄ / longer ₅

24. I am a non-smoker ₁

I used to smoke foryears, and gave it up years ago ₂

I have been a smoker for the last years ₃

Now please go on to Section C

Section C

P A W

Your responses to these statements will help us understand your general work situation.

We want to know about your overall work during the last 12 months

Please answer ALL statements and indicate whether you agree or disagree with each statement by circling the appropriate number on the scale ranging from 1 COMPLETELY DISAGREE to 5 COMPLETELY AGREE.

1 2 3 4 5
 COMPLETELY DISAGREE COMPLETELY AGREE

		Disagree	Agree
1	I enjoy my work	1	2 3 4 5
2	My job meets my expectations	1	2 3 4 5
3	I can turn to a fellow officer for help when I have problems	1	2 3 4 5
4	I get satisfaction from my job	1	2 3 4 5
5	I like most of my fellow officers	1	2 3 4 5
6	My job is mentally demanding	1	2 3 4 5
7	I enjoy the tasks involved in my job	1	2 3 4 5
8	My fellow officers talk things over with me	1	2 3 4 5
9	My job involves a great deal of mental concentration	1	2 3 4 5
10	I am happy with my job	1	2 3 4 5
11	My job involves a great deal of responsibility	1	2 3 4 5
12	I would recommend my job and place of work to a friend	1	2 3 4 5
13	My job causes me to worry	1	2 3 4 5
14	I would choose the same job, in the same place, again	1	2 3 4 5
15	My fellow officers accept and support my new ideas	1	2 3 4 5

JS

MS

SS



GENERAL HEALTH QUESTIONNAIRE

GHQ-12

Please read this carefully:

We should like to know if you have had any medical complaints, and how your health has been in general, *over the past few weeks*. Please answer ALL the questions simply by underlining the answer which you think most nearly applies to you. Remember that we want to know about present and recent complaints, not those you had in the past. It is important that you try to answer ALL the questions.

Thank you very much for your co-operation.

HAVE YOU RECENTLY:

1	- been able to concentrate on whatever you're doing?	Better than usual	Same as usual	Less than usual	Much less than usual
2	- lost much sleep over worry?	Not at all	No more than usual	Rather more than usual	Much more than usual
3	- felt that you are playing a useful part in things?	More so than usual	Same as usual	Less useful than usual	Much less useful
4	- felt capable of making decisions about things?	More so than usual	Same as usual	Less so than usual	Much less capable
5	- felt constantly under strain?	Not at all	No more than usual	Rather more than usual	Much more than usual
6	- felt you couldn't overcome your difficulties?	Not at all	No more than usual	Rather more than usual	Much more than usual
7	- been able to enjoy your normal day-to-day activities?	More so than usual	Same as usual	Less so than usual	Much less than usual
8	- been able to face up to your problems?	More so than usual	Same as usual	Less able than usual	Much less able
9	- been feeling unhappy and depressed?	Not at all	No more than usual	Rather more than usual	Much more than usual
10	- been losing confidence in yourself?	Not at all	No more than usual	Rather more than usual	Much more than usual
11	- been thinking of yourself as a worthless person?	Not at all	No more than usual	Rather more than usual	Much more than usual
12	- been feeling reasonably happy, all things considered?	More so than usual	About same as usual	Less so than usual	Much less than usual

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